The SNAKE, Vol. 28, pp. 14–18, 1998

AN EVALUATION OF TWO DESIGNS OF STAMPED METAL TRAP FLAPS FOR USE IN OPERATIONAL TRAPPING OF BROWN TREE SNAKES (BOIGA IRREGULARIS)

Michael A. LINNELL[1], Richard M. ENGEMAN[2], Mikel E. PITZLER[1], Mahlon O. WATTEN[3], Gary F. WHITEHEAD[3] and Robert C. MILLER[3]

[1] USDA/APHIS/ADC, 1060 Route 16, Suite 103–C, Barrigada Heights, GU 96921, USA, [2] National Wildlife Research Center, 1716 Heath Parkway, Fort Collins, CO 80524–2719, USA, [3] USDA/APHIS/ADC, 720 O'Leary St. NW, Olympia, WA 98502, USA

ABSTRACT: Two designs for stamped metal flaps used in traps to capture brown tree snakes were compared in separate studies to standard traps with wire mesh flaps. No difference in capture rates were detected between traps with the wire mesh flap and either of the stamped metal flaps. The second study included information on escape rates and numbers of jammed flaps. In that study, the stamped metal flap design, using a set screw to insure one-way passage and a metal band on the exterior of the entrance to keep the hinge pin from jamming, produced proportionally fewer jammed doors and snake escapes than the wire mesh flap.

Key words: snake control, trap structure, capture rates, escape rates, Guam

The accidental introduction of the brown tree snake, *Boiga irregularis*, to the island of Guam in the 1940s (Fritts, 1987, 1988), resulted in the extirpation of most species of forest avifauna (Savidge, 1987). This exotic predator has also become a significant agricultural pest (Fritts and McCoid, 1991) and a public health and safety concern (Fritts et al., 1990). Because Guam is a focal point for trans-shipment of air and sea cargo to many other parts of the Pacific and mainland United States, there is considerable risk for introduction of the brown tree snake to other areas.

Control and containment activities at air and sea port facilities on Guam are used to curtail the further dispersal of the snakes. As part of this ongoing brown tree snake control program, efforts are being made to improve the equipment and methods used for trapping brown tree snakes. The traps currently used are modified crawfish traps made of 1/4 inch wire mesh with a live mouse protected in an interior cage as an attractant (Fig. 1). Two entrances to the traps provide easy access for snakes, but they also must prevent snakes from exiting, once inside. To accomplish this, a door mechanism is installed that consists of a PVC (polyvinylchloride) pipe reducer in which a hinged flap is hung. The flap serves as a one-way door by opening freely towards the inside, but not to the outside.

Flaps constructed from 1/4 inch hardware cloth (wire mesh) generally performed best in previous tests (Rodda et al., 1992). A clear lexan plastic flap punched with 7/32 inch holes and a similar design using stamped metal flaps were tested by the National Biological Service (NBS) personnel. Traps with wire mesh flaps generally outperformed the lexan and the initial version of stamped metal flaps (G. Rodda, personal communication). Here, we report on tests evaluating two new designs of stamped metal flaps while using wire mesh flaps as a standard for comparison.

Materials and Methods

Flap designs: Two styles of stamped metal flap were evaluated separately in two studies using the 1/4 inch wire mesh flap as a standard for comparison. Each of the three flap designs were hung in a 2×1 1/2 inch PVC pipe reducer. All three designs are shown in Fig. 2. The first stamped metal design, which we label as SM1, used a curved segment of stamped aluminum sheeting with a hinge on the top attaching it to the pipe reducer. A small tab was spot

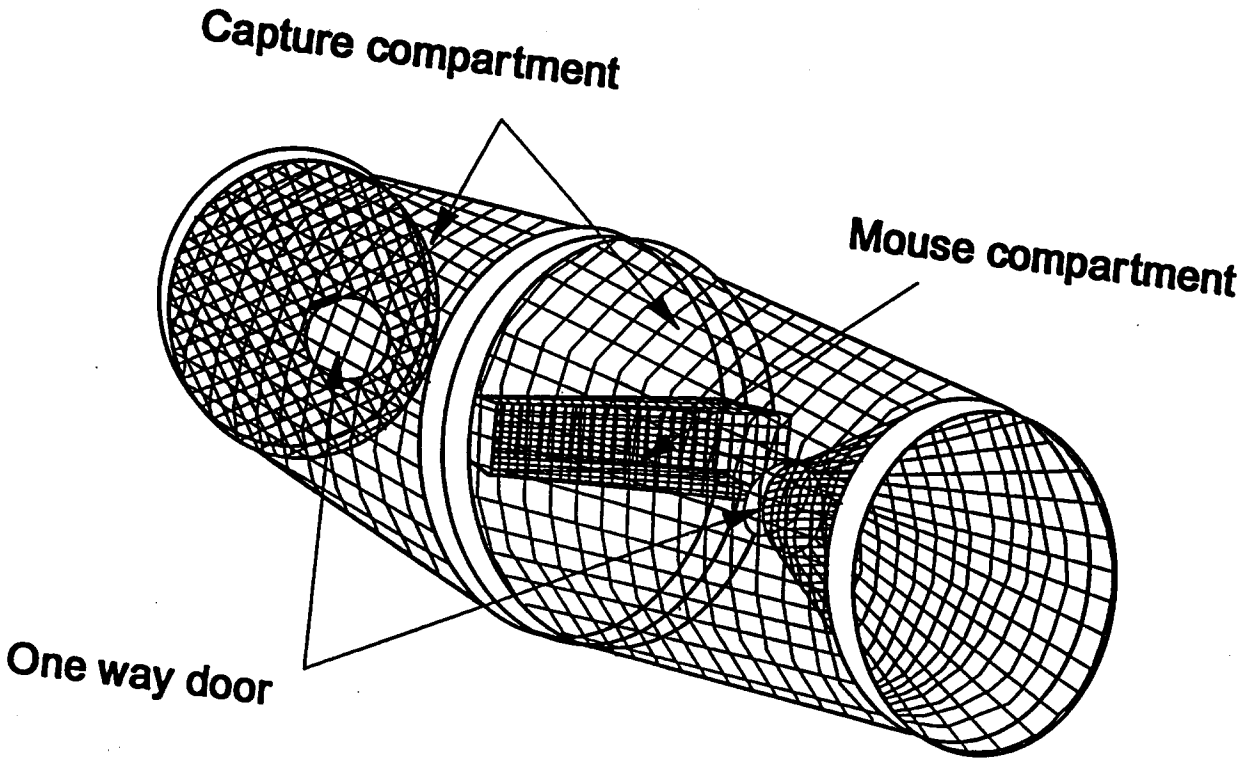

Fig. 1. Diagram of the traps used for capturing brown tree snakes.

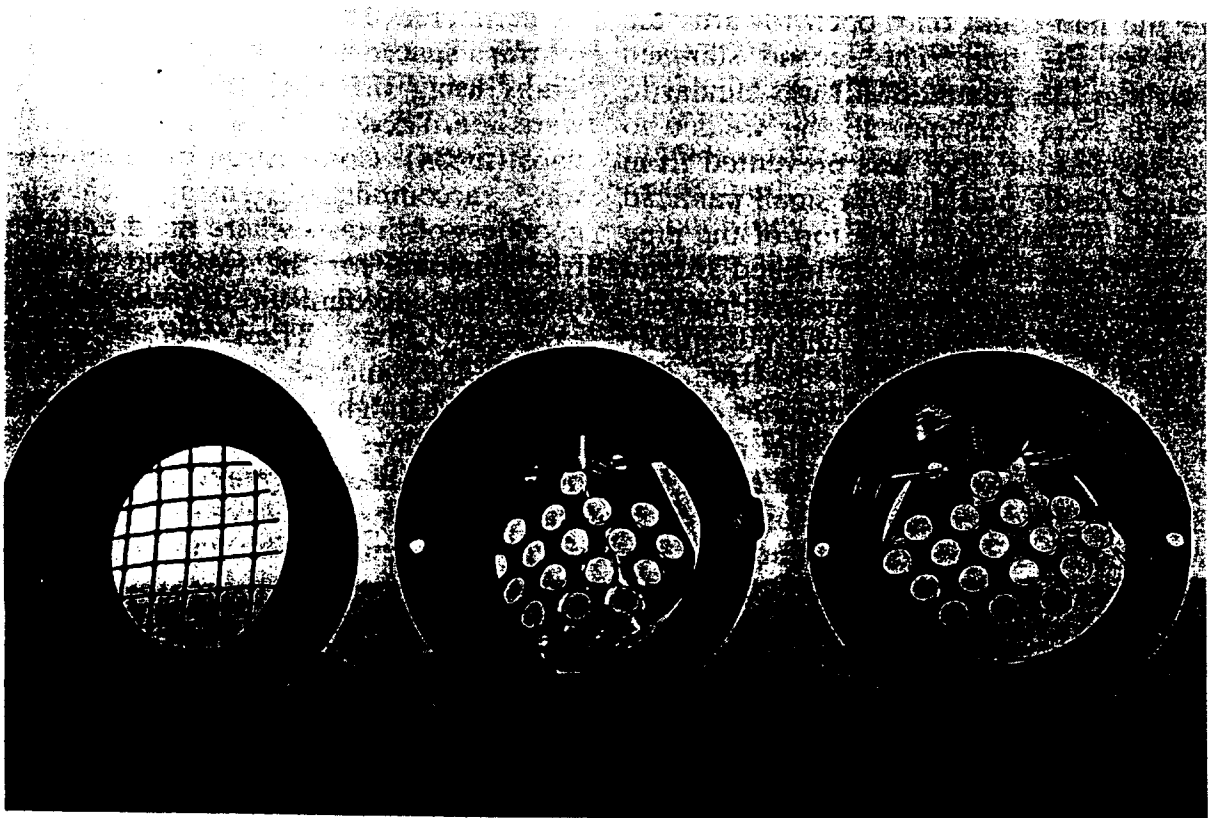

Fig. 2. Three trap flaps tested from left to right are 1) wire mesh (both studies), 2) stamped metal with tab attached (Study 1), 3) stamped metal with set screw (Study 2), a metal band encircles the exterior of the pipe reducer and is not visible in the photograph).

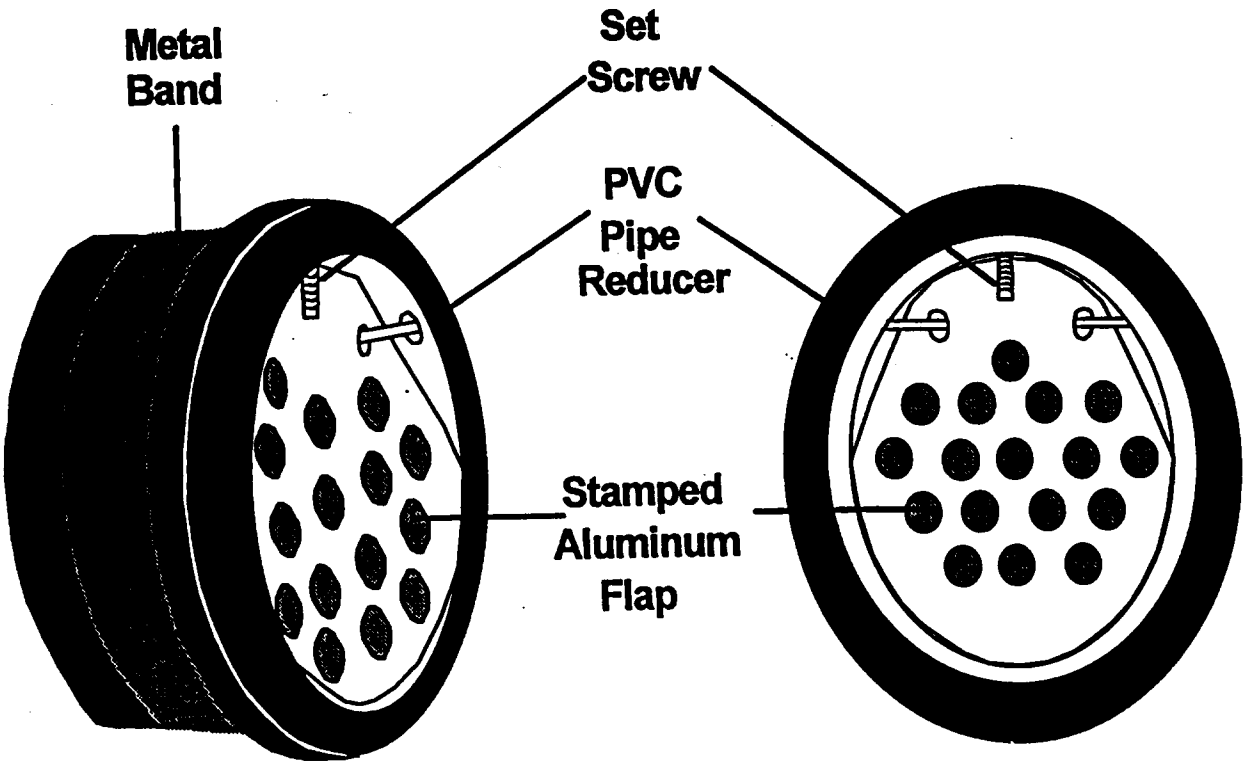

Fig. 3. Illustration of the SM2 trap flap design.

welded to the bottom of the flap to insure that the flap could only open towards the inside of the trap. The second stamped metal flap (designated SM2) was similar to the first except that no tab was welded to flap. Instead the door was prevented from opening to the outside by a small panhead set screw installed into the top of the pipe reducer. A metal band was attached around the exterior of the pipe reducer to prevent the hinge pin from sliding and potentially causing the door to jam if the trap was rotated off horizontal around its long axis. This more complex design is illustrated in Fig. 3. The wire mesh flap used for the comparisons was constructed of 1/4 inch galvanized hardware cloth and attached to the pipe reducer by wire rings. All traps used a live mouse in an interior chamber as a lure.

Study Area: Both studies were conducted in the Conventional Weapons Storage Area (CWSA) at Andersen Air Force Base on the north end of Guam. This area is characterized by a secondary limestone forest habitat that has been divided into rectangular units (blocks) by paved roads.

Study 1: This study compared the SM1 flap design to the wire mesh flap. One block, 133 m×457 m, near the north end of the CWSA was selected for trapping around its perimeter. This was accomplished using 69 traps spaced approximately 20 m apart. Traps using the SM1 flap design (n=35) were alternated with traps using wire mesh flaps (n=34). Comparison of capture rates was accomplished using chi-square goodness-of-fit tests where the difference in trap numbers for the two flap types was taken into account in the calculation of expected values. Traps were set on 25 August 1995 and remained in place for 40 consecutive nights. Traps were checked every 1–3 days. On 28 August 1995, 25 brown tree snakes captured in the first two nights of trapping were marked with microchip identification tags (MITs) and returned to the plot. All subsequent captures were monitored for MITs.

Study 2: This study compared the SM2 flap design to the wire mesh flap. At the time of the study only 10 traps of the SM2 design were available for testing. These were placed in a trap line of 20 traps total on a block in the south end of the CWSA where they were alternated with traps having wire mesh flaps. Traps were spaced approximately 15 m apart. All traps were new, thereby eliminating any potential for variability due to residual odors from

previous trapping operations, as has been demonstrated for various mammal species (e.g., Tobin et al., 1995). Traps were set on 15 September 1995 and remained in place for 48 consecutive nights. Traps were checked every 1–3 days. On 21 September one of the SM2 traps was removed for demonstration purposes elsewhere. At the same time one of the traps with wire mesh flaps was also removed to maintain equal trap effort among the two trap types. An aluminum foil tube 20 cm in length was placed in each trap to monitor for escapes (C. Clark, personal communication). Tube diameter in all traps was 2.5 cm for the first 4 days of trapping, but was changed to 4.0 cm in all traps for the final 44 days to obtain greater sensitivity. Traps with crushed tubes, but no snakes, were recorded as having produced an escape. Multiple escapes from the traps, if they occurred, could not be determined. The number of traps where the flaps jammed open were also recorded. Capture rates, escape rates and rates of flap jams were compared using chi-square goodness-of-fit tests. Comparison of proportions of opportunities that successfully resulted in captures were made using a chi-square test on contingency table data.

Results

Study 1: The 35 traps using the SM1 flap design captured 92 brown tree snakes in 40 nights (6.6 snakes/100 trap-nights). In the same time period the 34 traps using wire mesh flaps captured 100 snakes (7.4 snakes/100 trap-nights). No differences could be detected statistically between the capture rates for the flap types (χ^2=0.605, df=1, p=0.437). Of the 25 MIT marked snakes released back into the plot, 15 were recaptured in the plot. Five of the recaptures were in traps using wire mesh flaps, whereas 10 were captured in the traps using SM1 flaps. Binomial probability calculations indicate that it is unlikely (p=0.059) that the two flap designs would exhibit this division of the 15 recaptures if they had equal probabilities for recapturing the snakes.

Study 2: Over the course of the 48 nights of trapping, the traps using the SM2 flap design produced 59 captures (13.5 snakes/100 trap-nights) while the traps using wire mesh flaps produced 51 captures (11.7 snakes/100 trap-nights). The capture rates between these designs also could not be distinguished statistically (χ^2=0.582, df=1, p=0.446). However, differences were found between the designs for escape rates and flap jams. Only 1 jam was recorded for the SM2 design (0.2 jams/100 trap-nights), whereas 10 (2.3 jams/100 trap-nights) were found for the wire mesh (χ^2=7.364, df=1, p=0.007). Closely related to the jams was a difference in escape rates, with only 1 escape noted for traps with the SM2 design versus 9 for traps with wire mesh flaps (χ^2=6.400, df=1, p=0.011). Similarly, differences were found between the two flap designs in the proportion of capture opportunities that resulted in a successful capture (χ^2=6.982, df=1, p=0.008); 98.3% of opportunities resulted in a capture for traps using SM2 flap design versus 83.6% for traps with wire mesh flaps.

Discussion

The two designs of stamped metal flap tested in these trials represent a line of evolution in trap design. The flap design with the attached tab was produced as an improvement to the stamped metal design that was found to not perform as well as the wire mesh flap in NBS tests. The results from Study 1 had the tab design capturing snakes at a rate similar to the wire mesh flap, while producing a greater proportion of recaptures of tagged snakes. Even so, the stamped metal flap was further improved by making the flap less likely to jam by using the metal band to hold the hinge pin in place, and by reducing the opportunities for snakes to open the flap by using a set screw rather than a tab to block the door from opening outward. We found that the metal band circling the reducer permitted correct functioning of the flap even when the trap was rotated off its horizontal axis by 75–80°. The trial in Study 2 indicated that the SM2 design performed as well as the wire mesh flap for capturing brown tree snakes, but had fewer jammed flaps and snake escapes.

These trapping studies occurred in ideal field conditions, and with constant attention to trap maintenance. Under normal operational conditions more severe terrain and weather might be encountered and a single

person might be responsible for maintaining a large number of traps (>100 traps). Although any trapping effort requires regular maintenance of equipment, the stamped metal flaps with a set screw and metal band appeared to be most effective at withstanding the rigors that typify operational use in the field.

Acknowledgements.—This evaluation was conducted with funds provided to the U.S. Department of Agriculture/Animal and Plant Health Inspection Service/Animal Damage Control Operations/Washington State Director's Office by the U.S. Department of Defense under DOD MIPR-064-95, "Operational Control of Brown Tree Snakes in Guam." G. Rodda, M. Fall, R. Bruggers, R. Mauldin, P. Savarie C. Clark and J. Shivak provided valuable suggestions for this manuscript.

REFERENCES

Fritts, T. H. (1987) Movements of snakes via cargo in the Pacific Region. 'Elepaio, 47: 17–18.

Fritts, T. H. (1988) The brown tree snake, Boiga irregularis, a threat to Pacific Islands. Biological Report 88(31), U. S. Department of Interior, Fish and Wildlife Service, Washington, DC 20240. 36 pp.

Fritts, T. H., M. J. McCoid and R. L. Haddock. (1990) Risks to infants on Guam from bites of the brown tree snake (Boiga irregularis). Amer. J. Trop. Med. Hyg., 42: 607–611.

Fritts, T. H. and M. J. McCoid. (1991) Predation by the brown tree snake (Boiga *irregularis*) on poultry and other domesticated animals on Guam. Snake, 23: 75–80.

Rodda, G. H., Fritts, T. H., Clark, C. S., Gotte, S. W., Campbell, E. W. III and M. J. McCoid (1992) Trap techniques and population dynamics 1990–1992. U.S. Fish and Wildlife Service unpublished report, Washington, D.C.

Savidge, J. A. (1987) Extinction of an island forest avifauna by an introduced snake. Ecology, 68: 660–668.

Tobin, M. T., Engeman, R. M. and Sugihara, R. T. (1995) Effects of mongoose odors on rat capture success. J. Chem. Ecol. 21: 635–639.

要　約

ミナミオオガシラのトラップ実用化のための，トラップの金属扉の２つのデザインの評価

Michael A. Linnel[1)], Richard M. Engeman[2)], Mikel E. Pitzler[1)], Mahlon O. Watten[3)], Gary F. Whitehead[3)] and Robert C. Miller[3)]

ミナミオオガシラを捕獲するための，新しいトラップの金属扉の２つのデザインを，これまでの標準的な金網のトラップと比較して，検討評価した．捕獲率にヘビの逃走率と扉の故障を考慮に入れた．その場合，扉の１方向への動きを保証するねじを付け，またちょうつがいを押さえる金属バンドを外側に着けたタイプで，金網のトラップに比べ故障が少なく，逃走率が低く押さえられた．

[1)]USDA/APHIS/ADC, Guam

[2)]National Wildlife Research Center, Colorado

[3)]USDA/APHIS/ADC, Washington